Beam Power Tube

CERAMIC-METAL SEALS
"ONE-PIECE" ELECTRODE DESIGN
CONDUCTION COOLED

COAXIAL-ELECTRODE STRUCTURE
INTEGRAL CONDUCTION CYLINDER
180-WATTS CW INPUT UP TO 1215 Mc

MATRIX-TYPE, OXIDE-COATED, UNIPOTENTIAL CATHODE

For Use at Frequencies up to 2000 Mc under Severe Shock and Vibration

GENERAL DATA

Electrical:

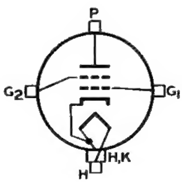
Heater, for Matrix-Type, Oxide-Coated, Unipotential Cathode:		
Voltage (AC or DC)▲	6.3 ± 10%	volts
Current at heater volts = 6.3	3.2	amp ←
Minimum heating time	60	sec
Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 250, grid-No.2 volts = 250, and plate ma. = 100	18	
Direct Interelectrode Capacitances:●		
Grid No.1 to plate	0.065 max.	µµf
Grid No.1 to cathode & heater	14	µµf
Plate to cathode & heater	0.019 max.	µµf
Grid No.1 to grid No.2	19	µµf
Grid No.2 to plate	4.5	µµf
Grid No.2 to cathode & heater	1.3 max.	µµf

Mechanical:

Operating Position	Any
Overall Length	1.885" + 0.70" − 0.80"
Greatest Diameter (See *Dimensional Outline*)	1.119"
Weight (Approx.)	2 oz
Socket:	
For frequencies up to about 400 Mc	★
For use at higher frequencies	See *Mounting Arrangement*

Terminal Connections (See *Dimensional Outline*):

G_1 – Grid-No.1-Terminal Contact Surface
G_2 – Grid-No.2-Terminal Contact Surface
H – Heater-Terminal Contact Surface



H,K – Heater- & Cathode-Terminal Contact Surface
P – Plate-Terminal Contact Surface

Thermal:

Conduction-Cylinder Temperature	250 max.	°C
Seal Temperature (Plate, grid No.2, grid No.1, cathode, and heater)	250 max.	°C

← Indicates a change.

Cooling, Conduction:

The conduction cylinder must be thermally coupled to a constant-temperature device (heat sink—solid or liquid) to limit the conduction cylinder to the specified maximum value of 250° C. The plate, grid-No.2, grid-No.1, cathode, and heater terminals may also require coupling to the heat sink to limit their respective seal temperature to the specified maximum value of 250° C.

AF POWER AMPLIFIER & MODULATOR — Class AB_1♦

Maximum CCS♠ Ratings, *Absolute-Maximum Values:*

DC PLATE VOLTAGE	1000	max.	volts
DC GRID-No.2 VOLTAGE	300	max.	volts
MAX.-SIGNAL DC PLATE CURRENT♠	180	max.	ma
MAX.-SIGNAL PLATE INPUT♠	180	max.	watts
MAX.-SIGNAL GRID-No.2 INPUT♠	4.5	max.	watts
PLATE DISSIPATION♠	♣		

Typical CCS Push-Pull Operation:

Values are for 2 tubes

DC Plate Voltage	650	850	volts
DC Grid-No.2 Voltage●	300	300	volts
DC Grid-No.1 Voltage from fixed-bias source	-15	-15	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage#	30	30	volts
Zero-Signal DC Plate Current	80	80	ma
Max.-Signal DC Plate Current	200	200	ma
Zero-Signal DC Grid-No.2 Current	0	0	ma
Max.-Signal DC Grid-No.2 Current	20	20	ma
Effective Load Resistance (Plate to plate)	4330	7000	ohms
Max.-Signal Driving Power (Approx.)	0	0	watts
Max.-Signal Power Output (Approx.)	50	80	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition:*

For fixed-bias operation	30000	max.	ohms
For cathode-bias operation	Not recommended		

AF POWER AMPLIFIER & MODULATOR — Class AB_2♣

Maximum CCS♠ Ratings, *Absolute-Maximum Values:*

DC PLATE VOLTAGE	1000	max.	volts
DC GRID-No.2 VOLTAGE	300	max.	volts
MAX.-SIGNAL DC PLATE CURRENT♠	180	max.	ma
MAX.-SIGNAL DC GRID-No.1 CURRENT♠	30	max.	ma
MAX.-SIGNAL PLATE INPUT♠	180	max.	watts
MAX.-SIGNAL GRID-No.2 INPUT♠	4.5	max.	watts
PLATE DISSIPATION♠	♣		

Typical CCS Push-Pull Operation:

Values are for 2 tubes			
DC Plate Voltage	650	850	volts
DC Grid-No.2 Voltage•	300	300	volts
DC Grid-No.1 Voltage from fixed-bias source	-15	-15	volts
Peak AF Grid-No.1-to-Grid-No.1 Voltage	46	46	volts
Zero-Signal DC Plate Current	80	80	ma
Max.-Signal DC Plate Current	355	355	ma
Zero-Signal DC Grid-No.2 Current	0	0	ma
Max.-Signal DC Grid-No.2 Current	25	25	ma
Max.-Signal DC Grid-No.1 Current	15	15	ma
Effective Load Resistance (Plate to plate)	2450	3960	ohms
Max.-Signal Driving Power (Approx.)†	0.3	0.3	watt
Max.-Signal Power Output (Approx.)	85	140	watts

LINEAR RF POWER AMPLIFIER

Single-Sideband Suppressed-Carrier Service

Maximum CCS♠ Ratings, ***Absolute-Maximum Values:***

	Up to 1215 Mc		
DC PLATE VOLTAGE	1000	max.	volts
DC GRID-No.2 VOLTAGE	300	max.	volts
MAX.-SIGNAL DC PLATE CURRENT	180	max.	ma
MAX.-SIGNAL DC GRID-No.1 CURRENT	30	max.	ma
MAX.-SIGNAL PLATE INPUT	180	max.	watts
MAX.-SIGNAL GRID-No.2 INPUT	4.5	max.	watts
PLATE DISSIPATION	♣		

Typical CCS Class AB_1 "Single-Tone" Operation:‡

	Up to 60 Mc		
DC Plate Voltage	650	850	volts
DC Grid-No.2 Voltage•	300	300	volts
DC Grid-No.1 Voltage	-15	-15	volts
Zero-Signal DC Plate Current	40	40	ma
Zero-Signal DC Grid-No.2 Current	0	0	ma
Effective RF Load Resistance	2165	3500	ohms
Max.-Signal DC Plate Current	100	100	ma
Max.-Signal DC Grid-No.2 Current	10	10	ma
Max.-Signal DC Grid-No.1 Current	0	0	ma
Max.-Signal Peak RF Grid-No.1 Voltage	15	15	volts
Max.-Signal Driving Power (Approx.)	0	0	watts
Max.-Signal Power Output (Approx.)	25	40	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition:

For fixed-bias operation	30000 max.	ohms
For cathode-bias operation	Not recommended	

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1

Maximum CCS♦ Ratings, *Absolute-Maximum Values:*

	Up to 1215 Mc		
DC PLATE VOLTAGE	800	max.	volts
DC GRID-No.2 VOLTAGE	300	max.	volts
DC GRID-No.1 VOLTAGE	−100	max.	volts
DC PLATE CURRENT	150	max.	ma
DC GRID-No.1 CURRENT	30	max.	ma
PLATE INPUT	120	max.	watts
GRID-No.2 INPUT	3	max.	watts
PLATE DISSIPATION	♣		

Typical CCS Operation:

	At 400 Mc		
DC Plate Voltage	400	700	volts
DC Grid-No.2 Voltage§	200	250	volts
DC Grid-No.1 Voltage□	−20	−50	volts
DC Plate Current	100	130	ma
DC Grid-No.2 Current	5	10	ma
DC Grid-No.1 Current	5	10	ma
Driver Power Output (Approx.)◊	2	3	watts
Useful Power Output (Approx.)	16	45	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition . . . . . 30000♡ max. ohms

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy▲▲
and
RF POWER AMPLIFIER — Class C FM Telephony

Maximum CCS♦ Ratings, *Absolute-Maximum Values:*

	Up to 1215 Mc		
DC PLATE VOLTAGE	1000	max.	volts
DC GRID-No.2 VOLTAGE	300	max.	volts
DC GRID-No.1 VOLTAGE	−100	max.	volts
DC PLATE CURRENT	180	max.	ma
DC GRID-No.1 CURRENT	30	max.	ma
PLATE INPUT	180	max.	watts
GRID-No.2 INPUT	4.5	max.	watts
PLATE DISSIPATION	♣		

Typical CCS Operation:

	At 400 Mc		*At 1215 Mc*	
DC Plate Voltage	400	900	900	volts
DC Grid-No.2 Voltage●●	200	300	300	volts
DC Grid-No.1 Voltage★★	−35	−30	−22	volts
DC Plate Current	150	170	170	ma
DC Grid-No.2 Current	5	1	1	ma
DC Grid-No.1 Current	3	10	4	ma

Driver Power Output (Approx.)◊ . .	3	3	5	watts
Useful Power Output (Approx.) . .	23	80	40	watts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance under any condition . . . . 30000♡ max. ohms

▲ Because the cathode is subjected to considerable back bombardment as the frequency is increased with resultant increase in temperature, the heater voltage should be reduced depending on operating conditions and frequency to prevent overheating the cathode and resultant short life.

● Measured with special shield adapter.

★ For socket to be used with the 7842, consult manufacturers such as J-V-M Microwave Company, 9300 West 47th Street, Brookfield, Illinois; E.F. Johnson Company, Waseca, Minnesota; Collins Radio Company, 855 35th Street North, Cedar Rapids, Iowa; and Jettron Products, Route 10, Hanover, New Jersey.

♦ Subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

♁ Continuous Commercial Service.

♠ Averaged over any audio-frequency cycle of sine-wave form.

♣ Maximum plate dissipation is a function of the maximum plate input, efficiency of the class of service, and the effectiveness of the cooling system. See *Cooling, Conduction* under *General Data*, and also *Cooling Considerations*.

⊕ Preferably obtained from a fixed supply.

The driver stage should be capable of supplying the No.1 grids of the Class AB_1 stage with the specified driving voltage at low distortion.

* The resistance introduced into the grid-No.1 circuit by the input coupling should be held to a low value. In no case should it exceed the specified maximum value. Transformer- or impedance-coupling devices are recommended.

✱ Subscript 2 indicates that grid-No.1 current flows during some part of the input cycle.

† Driver stage should be capable of supplying the specified driving power at low distortion to the No.1 grids of the AB_2 stage. To minimize distortion, the effective resistance per grid-No.1 circuit of the AB_2 stage should be held at a low value. For this purpose, the use of transformer coupling is recommended.

‡ "Single-Tone" operation refers to that class of amplifier service in which the grid-No.1 input consists of a monofrequency rf signal having constant amplitude. This signal is produced in a single-sideband suppressed-carrier system when a single audio frequency of constant amplitude is applied to the input of the system.

§ Obtained preferably from a separate source modulated along with the plate supply.

□ Obtained from grid-No.1 resistor or from a combination of grid-No.1 resistor with either fixed supply or cathode resistor.

◊ The driver stage is required to supply tube losses and rf-circuit losses. It should be designed to provide an excess of power above the indicated values to take care of variations in line voltage, components, initial tube characteristics, and tube characteristics during life.

♡ If this value is insufficient to provide adequate bias, the additional required bias must be supplied by a cathode resistor or fixed supply.

▲▲ Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

●● Obtained preferably from a fixed supply, or from the plate supply voltage with a voltage divider.

★★ Obtained from fixed supply, by grid-No.1 resistor, by cathode resistor, or by combination methods.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
→1. Heater Current	1	2.90	3.55	amp
2. Direct Interelectrode Capacitances:				
Grid No.1 to plate	2	–	0.065	$\mu\mu$f
Grid No.1 to cathode & heater	2	11.8	15.2	$\mu\mu$f
Plate to cathode & heater	2	–	0.019	$\mu\mu$f
Grid No.1 to grid No.2	2	17.3	21.9	$\mu\mu$f
Grid No.2 to plate	2	4	5.1	$\mu\mu$f
Grid No.2 to cathode & heater	2	–	1.3	$\mu\mu$f
→3. Grid-No.1 Voltage	1,3	–6	–18	volts
4. Reverse Grid-No.1 Current	1,3	–	–20	μa
5. Grid-No.2 Current	1,3	–8	2	ma
6. Peak Emission Voltage	1,4	–	400	volts
7. Interelectrode Leakage Resistance	5	1	–	megohm
8. Useful Power Output	6	80	–	watts

Note 1: With 6.3 volts ac or dc on heater.

Note 2: Measured with special shield adapter.

Note 3: With dc voltage of 1000 volts, dc grid-No.2 voltage of 300 volts, and dc grid-No.1 voltage adjusted to give a dc plate current of 115 ma.

Note 4: For conditions with 6.3 volts on heater; grid No.1, grid No.2, and plate tied together; and pulse-voltage source connected between plate and cathode. Pulse duration is 2 microseconds, pulse-repetition frequency is 60 pps, and duty factor is 0.00012. The voltage-pulse amplitude is adjusted until a peak cathode current of 10 amperes is obtained. After 1 minute at this value, the voltage-pulse amplitude will not exceed 400 volts (peak).

Note 5: Under conditions with tube at 20° to 30° C for at least 30 minutes without any voltages applied to the tube. The minimum resistance between any two adjacent electrodes as measured with a 200-volt Megger-type ohmmeter having an internal impedance of 1 megohm, will be 1 megohm.

Note 6: In a single-tube, grid-driven, coaxial-cavity, class-C-amplifier circuit at 400 Mc and for conditions with 5.7 volts ac or dc on heater, dc plate voltage of 1000 volts, dc grid-No.2 voltage of 300 volts, grid-No.1 resistor adjustable between 1000 and 10,000 ohms, dc plate current of 180 ma. maximum, dc grid-No.1 current of 20 ma. maximum, and driver power output of 3 watts.

SPECIAL TESTS & PERFORMANCE DATA

Resonances in the tube mountings used in the following tests can cause the specified environmental conditions to produce greatly amplified effects. Extreme care must, therefore, be used in the design of the mountings to minimize resonances. Design details of mountings used by the RCA Electron Tube Division to perform these tests may be obtained from RCA Commercial Engineering, Harrison, N.J., on request.

50-g, 11-Millisecond Shock Test:

This test is performed on sample lots of tubes to determine the ability of the tube to withstand the specified long-

→ Indicates a change.

duration impact acceleration. Tubes are held rigid in six different positions in a Medium-Impact Shock Machine and are subjected to three blows in each position. At the end of this test, tubes are required to meet the limits for items 1, 3, 4, 7, and 8 under *Characteristics Range Values for Equipment Design.*

500-g, Nominal 3/4-Millisecond Shock Test:

This test is performed on sample lots of tubes to determine the ability of the tube to withstand the specified impact acceleration. Tubes are held rigid in four different positions in a High-Impact Shock Machine and are subjected to five blows in each position. At the end of this test, tubes are required to meet the limits for items 1, 3, 4, 7, and 8 under *Characteristics Range Values for Equipment Design.*

5-to-2000 cps Vibration Test:

This test is performed on sample lots of tubes to determine the ability of the tube to withstand variable-frequency vibration. With heater voltage of 6.3 volts ac or dc, dc plate supply voltage of 300 volts, dc grid-No.2 voltage of 250 volts, grid-No.1 voltage adjusted to give dc plate current of 10 ma., and plate load resistor of 2000 ohms. The tube is vibrated along each of three mutually perpendicular axes over an 8-minute sweep consisting of:

a. 5-to-10 cps with fixed double amplitude of 0.080 inch ± 10%.

b. 10-to-15 cps at fixed acceleration of 0.41 g ± 10%.

c. 15-to-75 cps with fixed double amplitude of 0.036 inch ± 10%.

d. 75-to-2000 cps at fixed acceleration of 10 g ± 10%.

During the above vibration tests, tubes will not show an rms output voltage in excess of 15 volts across the plate load resistor in the 5-to-2000 cycle range. At the end of this test, tubes are required to meet the limits for items 1, 3, 4, 7, and 8 under *Characteristics Range Values for Equipment Design.*

COOLING CONSIDERATIONS

The conduction-cooling system consists, in general, of a constant-temperature device (heat sink) and suitable heat-flow path (coupling) between the heat sink and tube. Careful consideration should be given to the design of a heat-flow path through a coupling device having low electrical conductivity and high thermal conductivity.

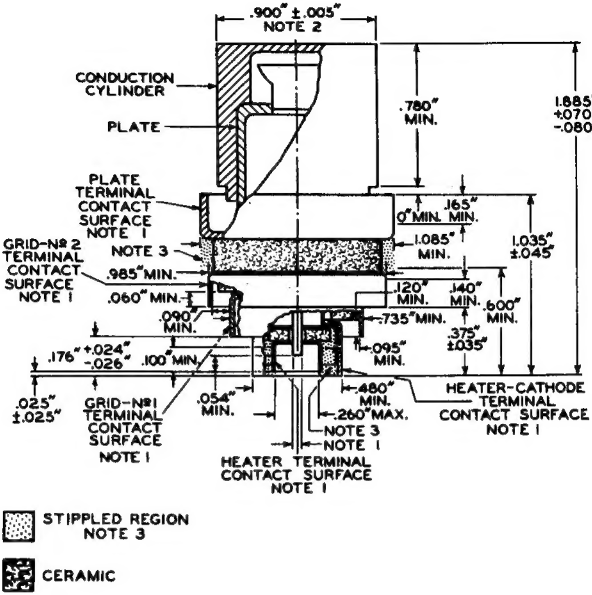
The maximum plate dissipation may be calculated from the equation:

$$W = KA\frac{(T_2 - T_1)}{L}$$

where:

- W = maximum plate dissipation in watts
- K = thermal conductivity♦♦ of the coupling material
- A = area measured at right angles to the direction of the flow of heat in square inches
- T_2, T_1 = temperature in degrees Centigrade of planes or surfaces under consideration
- L = length of heat path in inches through coupling material to produce temperature gradient

♦♦ Thermal conductivity is defined as the time rate of transfer of heat by conduction, through unit thickness, across unit area for unit difference of temperature. It is measured in watts per square inch for a thickness of one inch and a difference of temperature of 1° C.



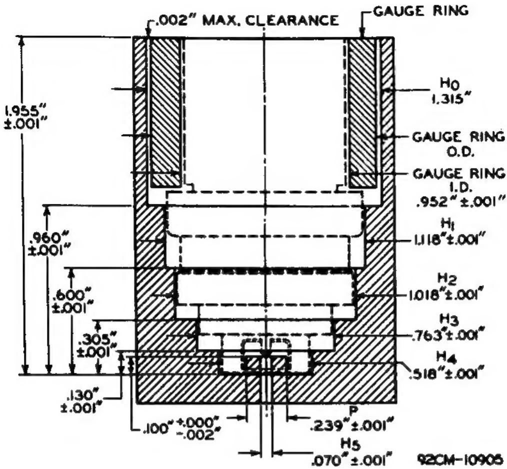
92CM-9218R4

NOTE 1: WITH THE CYLINDRICAL SURFACES OF THE PLATE TERMINAL, GRID-No.2 TERMINAL, GRID-No.1 TERMINAL, HEATER-CATHODE TERMINAL, AND HEATER TERMINAL CLEAN, SMOOTH, AND FREE OF BURRS, THE TUBE WILL ENTER A GAUGE AS SHOWN IN SKETCH G_1. THE TUBE IS PROPERLY SEATED IN THE GAUGE WHEN A 0.010"-THICKNESS GAUGE 1/8" WIDE WILL NOT ENTER BETWEEN THE HEATER-CATHODE TERMINAL AND THE BOTTOM SURFACE OF H_4. THE GAUGE IS PROVIDED WITH A SLOT TO PERMIT MAKING MEASUREMENT OF SEATING OF HEATER-CATHODE TERMINAL ON BOTTOM OF HOLE H_4.

NOTE 2: WITH THE TUBE SEATED IN GAUGE AND WITH THE CONDUCTION CYLINDER CLEAN, SMOOTH, AND FREE OF BURRS, THE GAUGE RING WILL SLIP OVER CONDUCTION CYLINDER AS SHOWN IN SKETCH G_1.

NOTE 3: KEEP ALL STIPPLED REGIONS CLEAR. DO NOT ALLOW CONTACTS OR CIRCUIT COMPONENTS TO PROTRUDE INTO THESE ANNULAR VOLUMES.

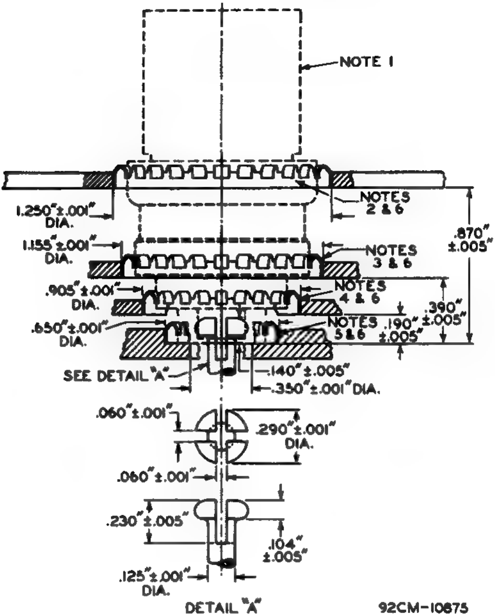
SKETCH G_1



THE AXES OF THE CYLINDRICAL HOLES H_1 THROUGH H_5 AND THE AXIS OF POST P ARE COINCIDENT WITHIN 0.001".

THE AXES OF THE GAUGE-RING INSIDE DIAMETER AND GAUGE-RING OUTSIDE DIAMETER ARE COINCIDENT WITHIN 0.001".

SUGGESTED MOUNTING ARRANGEMENT & LAYOUT OF ASSOCIATED CONTACTS



NOTE 1: IF A CLAMP IS USED, IT MUST BE ADJUSTABLE IN A PLANE NORMAL TO THE MAJOR TUBE AXIS TO COMPENSATE FOR VARIATIONS IN CONCENTRICITY BETWEEN THE CONDUCTION CYLINDER AND THE CONTACT TERMINALS.

NOTE 2: CONTACT RING No.97-252 OR FINGER STOCK No.97-380.

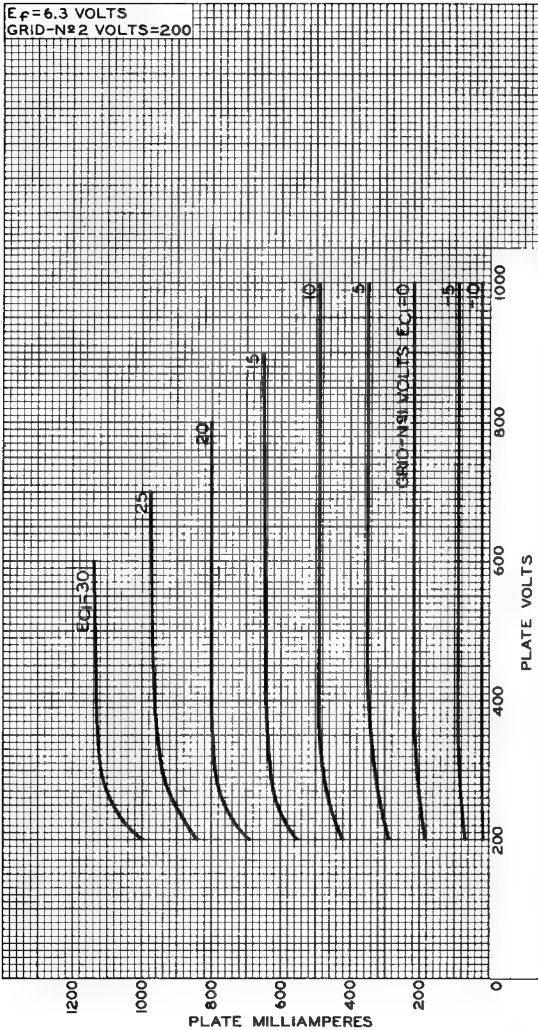
NOTE 3: CONTACT RING No.97-253 OR FINGER STOCK No.97-380.

NOTE 4: CONTACT RING No.97-254 OR FINGER STOCK No.97-380.

NOTE 5: CONTACT RING No.97-255 OR FINGER STOCK No.97-380.

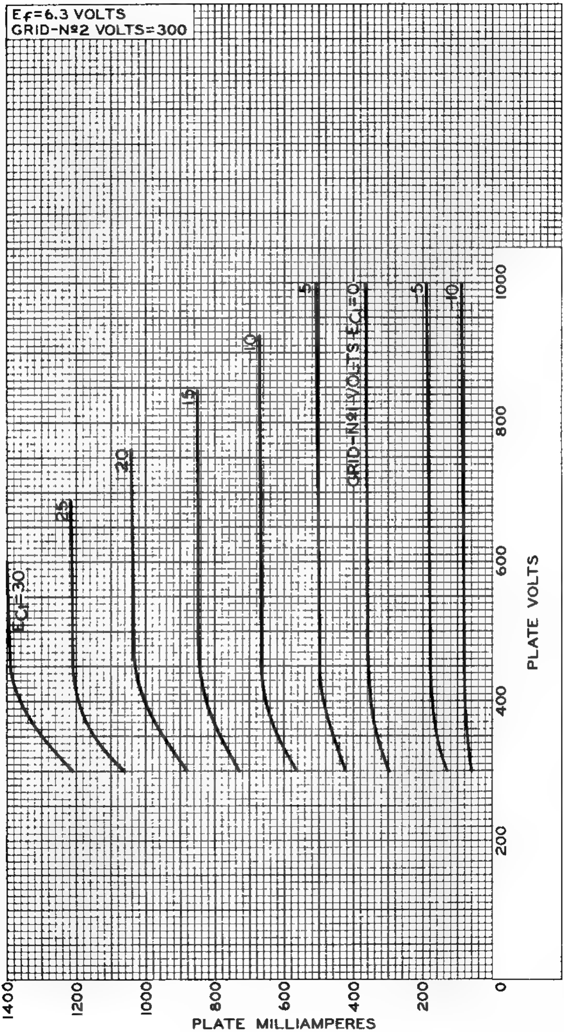
NOTE 6: THE SPECIFIED CONTACT RING OF PREFORMED FINGER STOCK AND FINGER STOCK No.97-380 PROVIDE ADEQUATE ELECTRICAL CONTACT, BUT THE FINGER STOCK No.97-380 IS LESS SUSCEPTIBLE TO BREAKAGE THAN THE SPECIFIED CONTACT RING. BOTH TYPES ARE MADE BY INSTRUMENTS SPECIALTIES COMPANY, LITTLE FALLS, NEW JERSEY.

TYPICAL PLATE CHARACTERISTICS



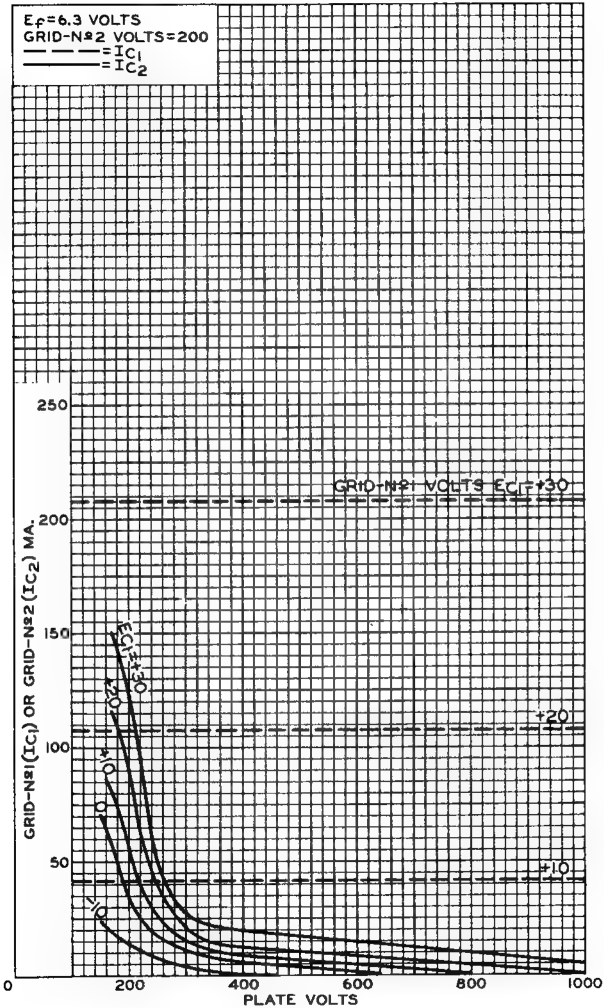
92CM-9228R2

TYPICAL PLATE CHARACTERISTICS



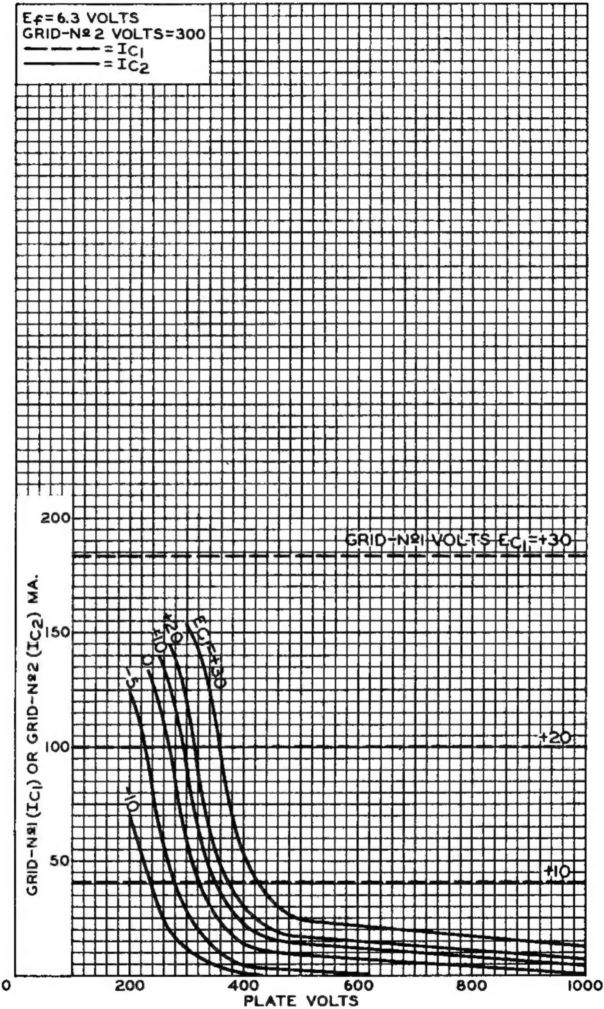
92CM-9222R1

TYPICAL CHARACTERISTICS



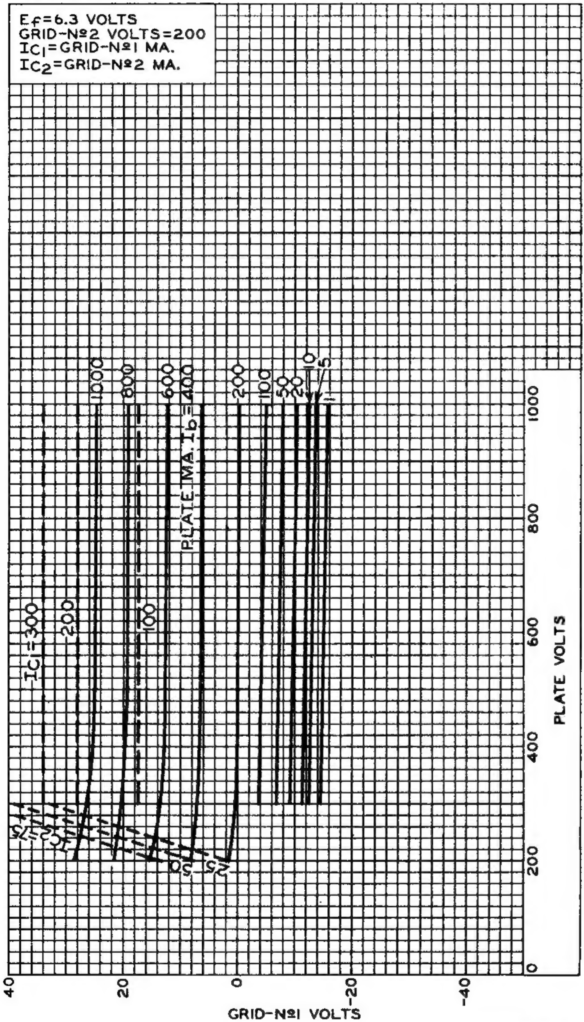
92CM-9224R1

TYPICAL CHARACTERISTICS



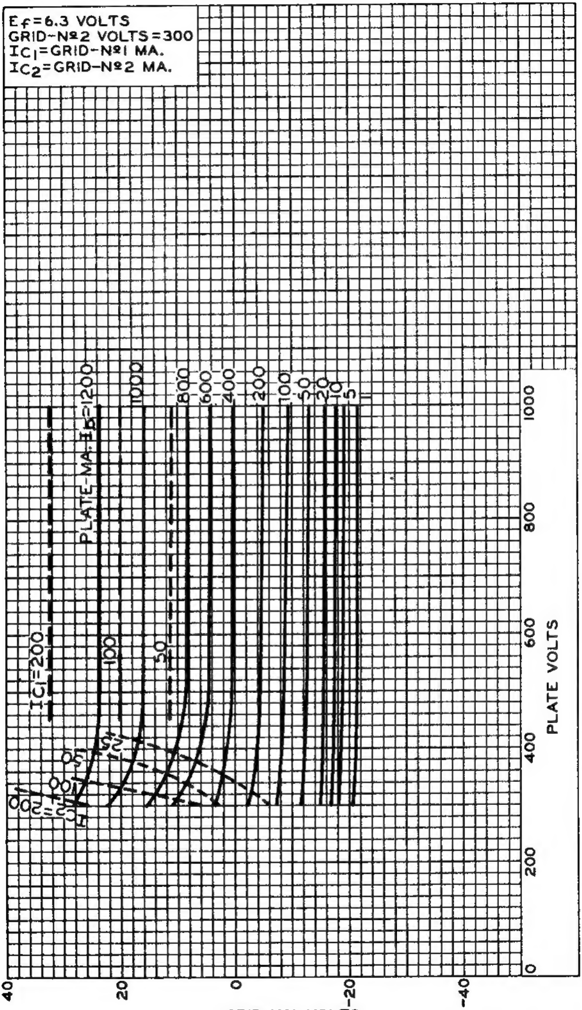
92CM-9225R2

TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-9233R1

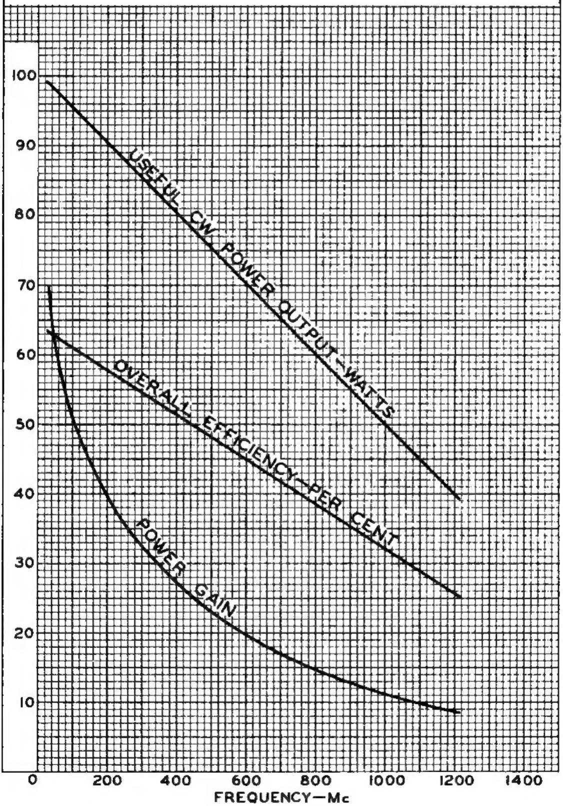
TYPICAL CONSTANT-CURRENT CHARACTERISTICS



92CM-9232RI

TYPICAL PERFORMANCE CHARACTERISTICS
In Class C Telegraphy or Class C FM Telephony Amplifier Service

E_f = ADJUSTED TO SIMULATE NORMAL OPERATING CONDITIONS OF HEATER IN UHF SERVICE
PLATE VOLTS = 900
GRID-No 2 VOLTS = 300
PLATE AMPERES = 0.170
OVERALL EFFICIENCY = USEFUL POWER OUTPUT IN LOAD DIVIDED BY DC PLATE INPUT
POWER GAIN = USEFUL POWER OUTPUT IN LOAD DIVIDED BY DRIVER POWER OUTPUT



92CM-9221